5
Diabetes

Co-Lead Agencies: Centers for Disease Control and Prevention;
National Institutes of Health

Contents

Goal

Through prevention programs, reduce the disease and economic burden of diabetes, and improve the quality of life for all persons who have or are at risk for diabetes.

Overview

Diabetes poses a significant public health challenge for the United States. Some 800,000 new cases are diagnosed each year, or 2,200 per day.[1, 2] The changing demographic patterns in the United States are expected to increase the number of people who are at risk for diabetes and who eventually develop the disease. Diabetes is a chronic disease that usually manifests itself as one of two major types: type 1, mainly occurring in children and adolescents 18 years and younger, in which the body does not produce insulin and thus insulin administration is required to sustain life; or type 2 occurring usually in adults over 30 years of age in which the body's tissues become unable to use its own limited amount of insulin effectively. While all persons with diabetes require self-management training, treatment for type 2 diabetes usually consists of a combination of physical activity, proper nutrition, oral tablets and insulin. Type 1 diabetes has been sometimes referred to as juvenile or insulin-dependent diabetes; and type 2 diabetes has been referred to as adult-onset or noninsulin dependent diabetes.

Issues

The occurrence of diabetes, especially type 2 diabetes, as well as associated diabetes complications, is increasing in the United States.[1, 2, 3] The number of persons with diabetes has increased steadily over the past decade; presently, 10.5 million persons have been diagnosed with diabetes, while 5.5 million persons are estimated to have the disease but are undiagnosed. This increase in the number of cases of diabetes has occurred particularly within certain racial and ethnic groups.[4] Over the past decade, diabetes has remained the seventh leading cause of death in the United States, primarily from diabetes-associated cardiovascular disease. While premenopausal nondiabetic women usually are at less risk of cardiovascular disease than men, the presence of diabetes in women is associated with a three- to four-fold increase in coronary heart disease compared to nondiabetic females.[5] In the United States, diabetes is the leading cause of nontraumatic amputations (approximately 57,000 per year or 150 per day); blindness among working-age adults (approximately 20,000 per year or 60 per day); and end-stage renal disease (ESRD) (approximately 28,000 per year or 70 per day).[6] (See Focus Area 28. Vision and Hearing and Focus Area 4. Chronic Kidney Disease.)

These and other health problems associated with diabetes contribute to an impaired quality of life and substantial disability among people with diabetes.[7]

Diabetes is a costly disease; estimates of the total attributable cost of diabetes are around $100 billion ($43 billion direct; $45 billion indirect).[8, 9] Hospitalizations for diabetes-associated cardiovascular disease account for the largest component of the direct costs. However, diabetes management is occurring increasingly in the outpatient setting, and more people with diabetes are using nursing home facilities.[8, 9]

Diabetes is a major clinical and public health challenge within certain racial and ethnic groups where both new cases of diabetes and the risk of associated complications are great.[4, 10]

These realities are especially disturbing given the validated efficacy and economic benefits of secondary prevention (controlling glucose, lipid, and blood pressure levels) and tertiary prevention (screening for early diabetes complications [eye, foot, and kidney abnormalities], followed by appropriate treatment and prevention strategies).[11, 12, 13, 14, 15, 16, 17] For many reasons, however, these scientifically and economically justified prevention programs are not used routinely in daily clinical management of persons with diabetes.[18, 19, 20] Diabetes is thus a "wasteful" disease. Strategies that would lessen the burden of this disease are not used regularly, resulting in unnecessary illness, disability, death, and expense.

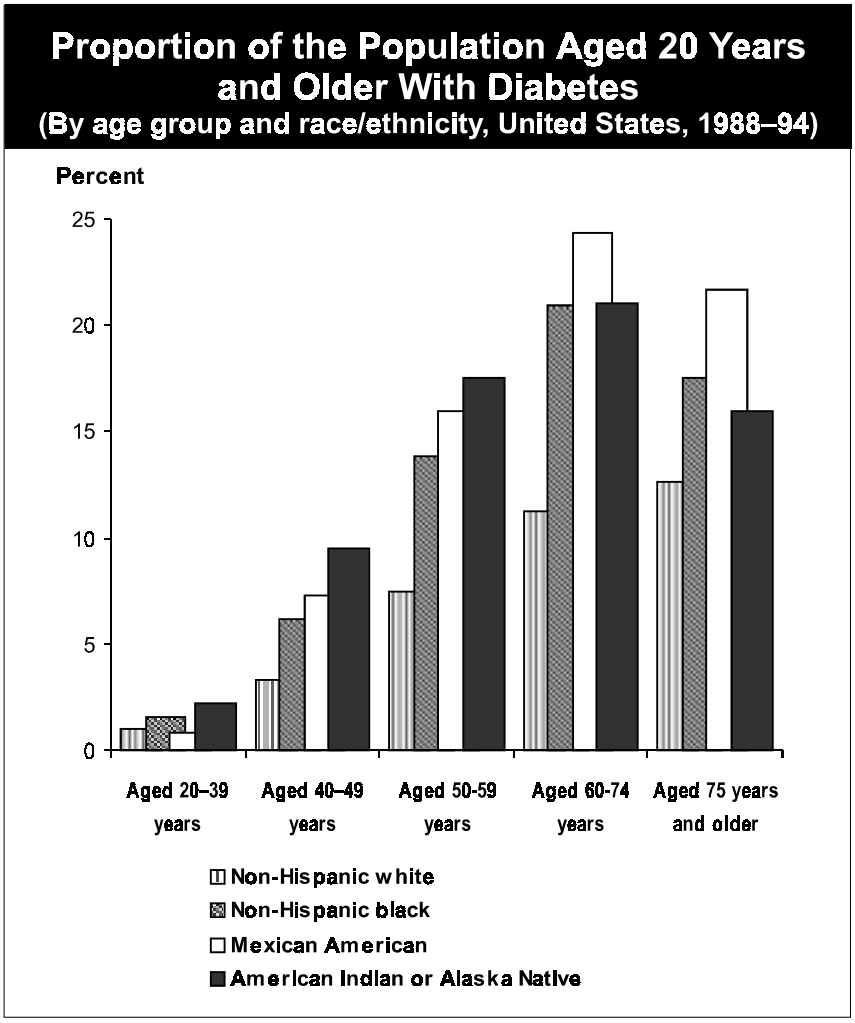
Trends

The toll of diabetes on the health status of people in the United States is expected to worsen before it improves, especially in vulnerable, high-risk populations—African Americans, Hispanics, American Indians or Alaska Natives, Asians or other Pacific Islanders, elderly persons, and economically disadvantaged persons. Several factors account for this chronic disease epidemic, including behavioral elements (improper nutrition, for example, increased fat consumption; decreased physical activity; obesity); demographic changes (aging, increased growth of "at-risk populations"); improved ascertainment and surveillance systems that more completely capture the actual burden of diabetes; and the relative weakness of interventions to change individual, community, or organizational behaviors.[1, 3, 7, 21] Several other interrelated factors influence the present and future burden of diabetes, including genetics, cultural and community traditions, and socioeconomic status. In addition, unanticipated scientific breakthroughs, the characteristics of the health care system, and the level of patient knowledge and empowerment all have a great impact on the amount of disease burden associated with diabetes.

Personal behaviors. "Westernization," which includes a diet high in fat and processed foods as well as total calories, has been associated with a greater number of overweight persons in the United States when compared to a decade ago, especially within certain racial and ethnic groups, for example, African-American females.[22, 23] Obesity, improper nutrition (including increased ingestion of fats and processed foods), and lack of physical activity are occurring in persons under age 15 years. These behaviors and conditions may explain the increasing diagnosis of

type 2 diabetes in teenagers.[24, 25] Increased television watching associated with diminished physical activity also may contribute to the emergence of type 2 diabetes in youth.[24, 25, 26, 27]

Demographics. Diabetes is most common in persons over age 60 years.[28] Increased insulin resistance and gradual deterioration in the function of insulin-producing cells may account for this phenomenon. As the population in the United States ages, especially as the number of persons who are 60 years and



Sources: Harris et al. *Diabetes Care* 21(4):518–24, 1998; Indian Health Service national outpatient database.

older grows, an increase in the number of people with diabetes is expected. While studies indicate that aging itself may not be a major factor in the substantial increase in the number of persons with diabetes,[21] present and future prevention strategies for diabetes will be associated with a greater lifespan for persons with diabetes.[29]

Other changes in the U.S. population can be expected to affect the number of persons with diabetes. By 2050, almost half of the population will be other than white

(53 percent white; 24 percent Hispanic; 14 percent African American; and 8 percent Asian).[30] Because these racial and ethnic groups are at greater risk for diabetes and associated complications, and because of rising levels of obesity and physical inactivity in the general population, the number of persons with diabetes is expected to increase into the first few decades of the 21st century.[31]

Ascertainment. Known as the "hidden" disease, diabetes is undiagnosed in an estimated 5 million persons.[32, 33] In addition, complications and health services associated with diabetes frequently are not recorded on death certificates,[34, 35] hospital discharge forms,[36] emergency department paperwork, and other documents. Much of this "missing" burden of diabetes now is being captured due to improved surveillance and data systems,[37] including boxes on data forms to indicate the presence of diabetes and screening programs for undiagnosed diabetes in high-risk persons.[32] Thus, the real—but previously undocumented—burden of diabetes is becoming better recognized.

Limitations in programs to change behaviors. Scientific evidence indicates that secondary and tertiary prevention programs are effective in reducing the burden of diabetes. Yet changing the behaviors of persons with diabetes, health care providers, or other individuals or organizations involved in diabetes health care (for example, health maintenance organizations and employers), is difficult. Although many factors account for these challenges,[37] more effective interventions will need to be developed and implemented to improve the practice of diabetes care. Several other factors influence the present and future burden of diabetes, including genetics, culture, socioeconomic status (SES), scientific discoveries, and the characteristics of both chronic diseases and the health care system.

Both type 1 and type 2 diabetes have a significant genetic component.[38, 39] For type 1 diabetes, genetic markers that indicate a greater risk for this condition have been identified; they are sensitive but not specific. Type 2 diabetes, especially in vulnerable racial and ethnic groups, may be associated with a "thrifty gene."[40, 41] Family and twin studies demonstrate considerable influence of genetics for type 2 diabetes, but a specific genetic marker for the common variety of type 2 diabetes has not been identified. The degree to which such genetic indicators can be both validated and clinically available will determine effectiveness of primary prevention trials.[42, 43]

Patient behaviors are influenced by beliefs and attitudes, and these are greatly affected by community and cultural traditions.[44, 45] In many racial and ethnic communities, fatalism, use of alternative medicine, desirability of rural living conditions, lack of economic resources, and other factors will influence significantly both availability of health care and the capabilities of persons with diabetes in handling their own care. Thirteen percent of the total U.S. population speak a language at home other than English. Cultural and linguistic factors affect interactions with health care providers and the system. The degree to which diabetes prevention strategies recognize and incorporate these traditions will largely determine program effectiveness.[46, 47]

The public health and medical communities are increasingly recognizing the influence of SES in the occurrence of new cases and progression of chronic diseases.[48, 49, 50] Chronic diseases, such as diabetes, reflect the social fabric of our society, and the degree to which employment, financial security, feelings of safety, education, and the availability of health care are addressed and improved within the United States will influence the likelihood of developing type 2 diabetes, as well as effectively managing both types of diabetes.[51] For example, unemployment without access to health insurance will substantially limit attention to and expenditures for preventive health practices.

Because acute infectious diseases were the dominant health threats during the first half of the 20th century, a dichotomous view of health existed, for example, people were either alive or dead, vaccinated or not vaccinated, etc. Death and length of life were the most important markers of disease burden and program effectiveness during those years. Chronic diseases such as diabetes pose different challenges because qualitative terms such as "doing better" are valid indicators of health improvement, as are measures of quality of life and disability. Further, a variety of nonphysician health professionals (for example, nurses or pharmacists) and nonhealth care professionals (for example, faith or community leaders, employers) can be involved in critical decisions affecting chronic diseases. Diabetes, like other chronic conditions, is long term and is affected by the environment where people live, work, and play. For diseases like diabetes, the accurate measurement of quality of life as an indicator of program effectiveness and the incorporation of nonhealth professionals at work or worship on the health team will influence the successes of preventive treatment programs.[37, 45, 46]

The rapidity and utility of scientific discoveries also will influence the control of the diabetes burden. In all aspects of scientific investigation, important observations about diabetes will continue to occur. These scientific results will greatly influence diabetes prevention and management,[54] but any scientific study that is not translated and used in daily practice is ultimately "wasted."[10, 55]

The availability of a responsive and effective health care system will determine access to quality care, especially in secondary and tertiary prevention.[56, 57] With the emergence of managed care, a person with diabetes theoretically could receive effective, economical, and planned preventive care that would minimize the diabetes burden.[58] Several additional changes need to occur within the managed care setting, however, to maximize fully this theoretical opportunity for persons with diabetes, including managed care (1) not denying access to potentially expensive patients, (2) allowing adequate time for health professionals to interact with patients, and (3) ensuring patient protection rights.

In addition, the apparent movement toward primary care will affect diabetes management and outcomes. At present, about 90 percent of all persons with diabetes receive continuous care from the primary care community. This is highly unlikely to change. Thus, the degree that improved relationships can be established be-

tween diabetes specialists and primary care health providers will determine the quality of diabetes care.[59]

People with diabetes spend a small percentage of their time in contact with health professionals. In addition to family, friends, and work colleagues, individual patient knowledge, beliefs, and attitudes affect diabetes management and outcomes. The ability to understand and influence individual, community, and organizational behaviors will influence significantly the success of preventive programs in diabetes.[60, 61, 62]

Disparities

Gaps exist among racial and ethnic groups in the rate of diabetes and its associated complications in the United States. Racial and ethnic communities, including African Americans, Hispanics, American Indians, and certain Pacific Islander and Asian American populations as well as economically disadvantaged or older Americans, suffer disproportionately compared to white populations. For example, the relative number of persons with diabetes in African American, Hispanic, and American Indian communities is one to five times greater than in white communities.[4] When compared to their white counterparts, death from diabetes is two times as great in African-American persons, and diabetes-associated renal failure is two and a half times that in Hispanic individuals with diabetes.[1, 6, 7]

Particularly within certain racial and ethnic groups, there are four potential individual reasons for the greater burden of diabetes:

Greater number of cases of diabetes. If diabetes is more common, then more amputations, death, and other complications from diabetes would be expected.

Greater seriousness of diabetes. If hyperglycemia or other serious comorbid conditions, such as high blood pressure or elevated blood lipids, are present in certain racial and ethnic groups, a greater diabetes-related disease burden would occur. Many other factors could be involved, including genetics and excess weight. “Greater seriousness” of diabetes can be determined by comparing, for example, death or amputation rates for specific racial and ethnic diabetic groups with those rates in the general diabetes population.

Inadequate access to proper diabetes prevention and control programs. If diabetes services, such as self-management training programs or eye-retina examinations, are not a part of routine diabetes care, then effective programs to reduce the burden of diabetes will not be accessed and used. These essential diabetes services often are provided by specialists. Unfortunately, many diabetes “at-risk” groups reside in medically undeserved areas or are without adequate insurance, and thus do not receive these types of preventive services.

Improper quality of care. If diabetes management services are available, but the quality of that service is inadequate, prevention programs would not be effective in reducing the burden of diabetes.

Identifying the reasons for disparities in diabetes health outcomes is important in tailoring programs to those specific areas where deficiencies exist. Collection of racial and ethnic health services data for all health activities is critical to designate the reason for the greater disease burden.

Opportunities

Opportunities to meet the challenges of diabetes lie in four "transition points" in the natural history of this disease and the preventive interventions which target them: primary prevention, screening and early diagnosis, access, and quality of care (secondary and tertiary prevention).[63]

The transition points and associated public health intervention are as follows:

- Transition Point 1: From No Diabetes to Diabetes Present (although not recognized). Intervention, *Primary Prevention.*
- Transition Point 2: From Diabetes Not Recognized to Diabetes Recognized (but preventive diabetes care not provided). Intervention, *Screening/Early Diagnosis.*
- Transition Point 3: From No Care to Diabetes Care Applied. Intervention, *Access*.
- Transition Point 4: From Improper Care to Proper Care. Intervention, *Quality of Care.* (Secondary and Tertiary Prevention—for example, glucose control and decreasing diabetes complications.)

Each transition point represents a diabetes prevention and control opportunity that is contained in the diabetes objectives of Healthy People 2010. Objectives are categorized as: (1) diabetes education; (2) burden of disease (new cases, existing cases, undiagnosed diabetes, death, pregnancy complications); (3) macrovascular, microvascular, and metabolic complications; (4) laboratory services (lipids, glycosylated hemoglobin, microalbumin measurements); (5) health provider services (eye, foot, and dental examinations); and (6) patient protection behaviors (aspirin, self-glucose monitoring). These objectives measure both the processes and outcomes of preventive diabetes programs.

To improve the quality of diabetes care, the Diabetes Quality Improvement Project (DQIP)—a joint public/private effort—has identified a set of measures to track critical performance measures of diabetes management. Through the Quality Interagency Coordination (QuIC) task force, Federal agencies with health care

responsibilities are collaborating to use DQIP to better focus efforts to improve diabetes care.

Interim Progress Toward Year 2000 Objectives

In Healthy People 2000, five diabetes-related objectives were included in a group of objectives addressing chronic conditions linked by their potential impact on quality of life and disability. Of these five objectives, eye examinations is moving toward the 2000 target. Death from diabetes, nonretinal diabetes complications, new cases of diabetes, and the number of existing cases are all moving away from the 2000 targets. Diabetes education is increasing in frequency among persons with diabetes.

These changes in direction need to be considered carefully with regard to significance, causes, and implications. The greater number of new cases of ESRD among persons with diabetes may in part be due to "ascertainment," that is persons with diabetes were not in the past but now are allowed access to ESRD treatment programs. Similarly, while new cases of type 2 diabetes truly may be increasing in association with obesity and inactivity, a higher number of cases of diabetes also may reflect increased efforts to screen for previously undiagnosed diabetes as well as decreased deaths from such conditions as diabetic acidosis or amputations. Thus, an increased number of existing cases of type 2 diabetes may in part reflect successes in other types of diabetes prevention programs.

Note: Unless otherwise noted, data are from Centers for Disease Control and Prevention, National Center for Health Statistics, *Healthy People 2000 Review, 1998-99.*

Diabetes

Goal: Through prevention programs, reduce the disease and economic burden of diabetes, and improve the quality of life for all persons who have or are at risk for diabetes.

Number	Objective
5-1	Diabetes education
5-2	Prevent diabetes
5-3	Reduce diabetes
5-4	Diagnosis of diabetes
5-5	Diabetes deaths
5-6	Diabetes-related deaths
5-7	Cardiovascular deaths in persons with diabetes
5-8	Gestational diabetes
5-9	Foot ulcers
5-10	Lower extremity amputations
5-11	Annual urinary microalbumin measurement
5-12	Annual glycosylated hemoglobin measurement
5-13	Annual dilated eye examinations
5-14	Annual foot examinations
5-15	Annual dental examinations
5-16	Aspirin therapy
5-17	Self-blood glucose monitoring

5-1. Increase the proportion of persons with diabetes who receive formal diabetes education.

Target: 60 percent.

Baseline: 40 percent of persons with diabetes received formal diabetes education in 1998 (age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: National Health Interview Survey (NHIS), CDC, NCHS.

Persons With Diabetes, 1993*	Diabetes Education Percent
TOTAL	45
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DSU
Native Hawaiian and other Pacific Islander	DSU
Black or African American	55
White	42
Hispanic or Latino	DSU
Not Hispanic or Latino	48
Black or African American	45
White	57
Gender	
Female	49
Male	41
Age	
Under 18 years	DNC
18 to 44 years	48
45 to 64 years	44
65 to 74 years	41
75 years and older	36

Persons With Diabetes, 1993*	Diabetes Education Percent
Education level (aged 25 years and older)	
Less than high school	46
High school graduate	39
At least some college	51
Disability status	
Persons with activity limitation	48
Persons without activity limitations	43
Geographic location	
Urban	47
Rural	42

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.
*New data for population groups will be added when available.

Diabetes patient education is uniformly viewed as effective and economical in the ultimate prevention of long term complications from diabetes. An individual with diabetes spends less than one percent of his or her time in contact with the health care system and on a daily basis must make a variety of critical decisions about diabetes. An informed and motivated patient is essential in managing the disease and reducing the risk of complications (for example, foot ulcers, hypoglycemia, and hypertension).[64, 65]

5-2. Prevent diabetes.

Target: 2.5 new cases per 1,000 persons per year.

Baseline: 3.1 new cases of diabetes per 1,000 persons (3-year average) in 1994-96.

Target setting method: Better than the best (retain year 2000 target).

Data source: National Health Interview Survey (NHIS), CDC, NCHS.

Total Population, 1994–96	New Cases of Diabetes Rate per 1,000
TOTAL	3.1
Race and ethnicity	
American Indian or Alaska Native	8.7
Asian or Pacific Islander	2.9

Total Population, 1994–96	**New Cases of Diabetes** Rate per 1,000
Asian	DSU
Native Hawaiian and other Pacific Islander	DSU
Black or African American	3.7
White	3.0
Hispanic or Latino	3.5
Not Hispanic or Latino	3.1
Black or African American	3.8
White	2.9
Gender	
Female	3.7
Male	2.6
Age	
Under 18 years	DNA
18 to 44 years	DNA
45 to 64 years	6.5
65 to 74 years	DNA
75 years and older	DNA
Education level (aged 25 years and older)	
Less than high school	7.7
High school graduate	4.0
At least some college	3.8
Geographic location	
Urban	DNA
Rural	DNA
Disability status	
Persons with activity limitations	DNA
Persons without activity limitations	DNA

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.

5-3. Reduce the overall rate of diabetes that is clinically diagnosed.

Target: 25 overall cases per 1,000 population.

Baseline: 40 overall cases (including new and existing cases) of diabetes per 1,000 population in 1997 (age adjusted to the year 2000 standard population).

Target setting method: Better than the best (retain year 2000 target).

Data source: National Health Interview Survey (NHIS), CDC, NCHS.

Total Population, 1997	**Cases of Diagnosed Diabetes** Rate per 1,000
TOTAL	40
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DSU
Native Hawaiian and other Pacific Islander	DSU
Black or African American	74
White	36
Hispanic or Latino	61
Not Hispanic or Latino	38
Black or African American	74
White	34
Gender	
Female	40
Male	39
Age	
Under 18 years	DSU
18 to 44 years	15
45 to 64 years	76
65 to 74 years	143
75 years and older	117
Education level (aged 25 years and older)	
Less than high school	95
High school graduate	58
At least some college	44

Total Population, 1997	Cases of Diagnosed Diabetes Rate per 1,000
Geographic location	
Urban	40
Rural	38
Disability status	
Persons with disabilities	87
Persons without disabilities	28

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

5-4. Increase the proportion of adults with diabetes whose condition has been diagnosed.

Target: 80 percent.

Baseline: 65 percent of adults aged 20 years and older with diabetes had been diagnosed in 1988-94.

Target setting method: Better than the best.

Data source: National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.

Adults Aged 20 Years and Older With Diabetes, 1988–94	Persons Whose Diabetes Has Been Diagnosed Percent
TOTAL	65
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	DNA
White	DNA
Hispanic or Latino	DNA
Mexican American	62

Adults Aged 20 Years and Older With Diabetes, 1988–94	Persons Whose Diabetes Has Been Diagnosed Percent
Not Hispanic or Latino	DNA
Black or African American	66
White	67
Gender	
Female	68
Male	61
Age	
20 to 44 years	67
45 to 64 years	61
65 to 74 years	69
75 years and older	69
Education level (aged 25 years and older)	
Less than high school	DNA
High school graduate	DNA
At least some college	DNA
Geographic location	
Urban	DNA
Rural	DNA
Disability status	
Persons with disabilities	DNA
Persons without disabilities	DNA

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.

Diabetes is increasingly common in the United States and the world. Many factors could be contributing to this "chronic disease epidemic," including an increase in new cases, a decrease in deaths, and improvements in detection.[1, 2, 3, 21, 63] Given the seriousness and cost associated with diabetes and the complexities of the disease, factors that account for the increasing frequency of diabetes should be identified.[66, 67, 68, 69]

5-5. Reduce the diabetes death rate.

Target: 45 deaths per 100,000 persons.

Baseline: 75 deaths per 100,000 persons were related to diabetes in 1997 (age adjusted to the year 2000 standard population).

Target setting method: 43 percent improvement.

Data source: National Vital Statistics System (NVSS), CDC, NCHS.

Total Population, 1997	**Diabetes Deaths** Rate per 100,000
TOTAL	75
Race and ethnicity	
American Indian or Alaska Native	107
Asian or Pacific Islander	62
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	130
White	70
Hispanic or Latino	86
Mexican American	115
Puerto Rican	87
Cuban	39
Not Hispanic or Latino	74
Black or African American	133
White	68
Gender	
Female	67
Male	87
Age	
Under 45 years	3
45 to 64 years	64
65 to 74 years	281
75 years and older	673
Education level (aged 25 to 64 years)	
Less than high school	48
High school graduate	38
At least some college	17

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

5-6. Reduce diabetes-related deaths among persons with diabetes.

Target: 7.8 deaths per 1,000 persons with diabetes.

Baseline: 8.8 deaths per 1,000 persons with diabetes listed anywhere on the death certificate in 1997 (age adjusted to the year 2000 standard population).

Target setting method: 11 percent improvement.

Data sources: National Vital Statistics System (NVSS), CDC, NCHS; National Health Interview Survey (NHIS), CDC, NCHS.

Persons With Diabetes, 1997	Diabetes-Related Deaths Rate per 1,000
TOTAL	8.8
Race and ethnicity	
American Indian or Alaska Native	3.3
Asian or Pacific Islander	5.4
Asian	6.3
Native Hawaiian and other Pacific Islander	2.5
Black or African American	8.1
White	8.9
Hispanic or Latino	7.4
Not Hispanic or Latino	8.9
Black or African American	8.1
White	9.0
Gender	
Female	8.6
Male	9.5
Age	
Under 45 years	2.0
45 to 64 years	7.7
65 to 74 years	20.1
75 years and older	73.4

Persons With Diabetes, 1997	Diabetes-Related Deaths Rate per 1,000
Education level (aged 25 to 64 years)	
Less than high school	4.7
High school graduate	7.3
At least some college	3.4

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

5-7. Reduce deaths from cardiovascular disease in persons with diabetes.

Target: 309 deaths per 100,000 persons with diabetes.

Baseline: 343 deaths from cardiovascular disease per 100,000 persons with diabetes in 1997 (age adjusted to the year 2000 standard population).

Target setting method: 10 percent improvement.

Data sources: National Vital Statistics System (NVSS), CDC, NCHS; National Health Interview Survey (NHIS), CDC, NCHS.

Persons With Diabetes, 1997	Cardiovascular Disease Deaths Rate per 100,000
TOTAL	343
Race and ethnicity	
American Indian or Alaska Native	93
Asian or Pacific Islander	223
Asian	263
Native Hawaiian and other Pacific Islander	113
Black or African American	283
White	359
Hispanic or Latino	270
Not Hispanic or Latino	351
Black or African American	284
White	367

Persons With Diabetes, 1997	Cardiovascular Disease Deaths Rate per 100,000
Gender	
Female	339
Male	363
Age	
Under age 45 years	38
45 to 64 years	306
65 to 74 years	850
75 years and older	3,222
Education level (aged 25 to 64 years)	
Less than high school	145
High school graduate	247
At least some college	125

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

Persons with diabetes experience death rates two to four times greater than nondiabetic persons, especially from cardiovascular disease. Other causes of death include renal failure, diabetic acidosis, and infection. Studies have clearly indicated that secondary prevention[70, 71, 72, 73] and tertiary prevention[74, 75, 76, 77] can reduce overall cardiac-related illness, disability, and death. Death rates and their significance, however, are complicated by how accurately and completely diabetes is recorded on death certificates.[34, 35] Thus, attention to both prevention behaviors to delay or prevent death, as well as death rates themselves, should be examined carefully.[70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81]

5-8. (Developmental) Decrease the proportion of pregnant women with gestational diabetes.

Potential data source: National Vital Statistics System (NVSS), CDC, NCHS.

Studies of diabetes and pregnancy are consistent in their conclusions that proper prepregnancy and pregnancy glycemia control and careful perinatal obstetrical monitoring are associated with reduction in perinatal death and congenital abnormalities. More recently, the importance of good fetal and neonatal nutrition in general, as well as in persons with diabetes, has been emphasized.[82, 83, 84, 85, 86, 87]

5-9. (Developmental) Reduce the frequency of foot ulcers in persons with diabetes.

Potential data source: National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.

5-10. Reduce the rate of lower extremity amputations in persons with diabetes.

Target: 5 per 1,000 persons with diabetes per year.

Baseline: 11 lower extremity amputations per 1,000 persons with diabetes in 1996.

Target setting method: 55 percent improvement.

Data sources: National Hospital Discharge Survey (NHDS), CDC, NCHS; National Health Interview Survey (NHIS), CDC, NCHS.

Persons With Diabetes, 1996	Lower Extremity Amputation Rate per 1,000
TOTAL	11
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	10
White	DNA
Hispanic or Latino	DSU
Not Hispanic or Latino	DSU
Black or African American	DSU
White	DSU
Gender	
Female	DNA
Male	DNA
Age	
Under 65 years	DNA
65 to 74 years	DNA
75 years and older	DNA

Persons With Diabetes, 1996	Lower Extremity Amputation Rate per 1,000
Education level (aged 25 years and older)	
Less than high school	DNC
High school graduate	DNC
At least some college	DNC

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.

5-11. (Developmental) Increase the proportion of persons with diabetes who obtain an annual urinary microalbumin measurement.

Potential data source: Behavioral Risk Factor Surveillance System (BRFSS), CDC, NCCDPHP.

Scientific evidence documents that with secondary and tertiary prevention, microvascular complications of diabetes can be substantially reduced. Improved quality of life, decreased death rates, and reduced costs all can result from improved clinical and public health diabetes prevention strategies directed at microvascular and metabolic complications from diabetes. Monitoring the consequences of these strategies through reductions in mid- and end-stage microvascular complications needs to be an important component in determining the effectiveness of national diabetes activities. In both type 1 and 2 diabetes, evidence is now firmly established that microvascular and metabolic complications of diabetes can be prevented through secondary (glucose[88, 89]) and tertiary (screening and early treatment of complications[90]) prevention strategies.[91, 92, 93, 94]

Improper nutrition, obesity, and inactivity appear to be significant risk factors for the development of type 2 diabetes. (See Focus Area 22. Physical Activity and Fitness, and Focus Area 19. Nutrition and Overweight.) In addition, nutrition, weight, and physical activity components are particularly critical in both glucose management and blood pressure and lipid control in persons with diabetes. These components are closely related to abilities to control both micro- and macrovascular diabetic complications. Given the discouraging trends in obesity and physical inactivity, these elements should be particularly and carefully monitored in persons with diabetes.[95, 96, 97]

5-12. Increase the proportion of adults with diabetes who have a glycosylated hemoglobin measurement at least once a year.

Target: 50 percent.

Baseline: 24 percent of adults aged 18 years and older with diabetes had a glycosylated hemoglobin measurement at least once a year (mean of data from 39 States in 1998; age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: Behavioral Risk Factor Surveillance System (BRFSS), CDC, NCCDPHP.

Adults Aged 18 Years and Older With Diabetes, 1998	**Annual Glycosylated Hemoglobin Assessment** Percent
TOTAL	24
Race and ethnicity	
American Indian or Alaska Native	29
Asian or Pacific Islander	48
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	21
White	25
Hispanic or Latino	22
Not Hispanic or Latino	25
Black or African American	21
White	24
Gender	
Female	24
Male	25
Education level (aged 25 years and older)	
Less than high school	13
High school graduate	19
At least some college	31

Adults Aged 18 Years and Older With Diabetes, 1998	Annual Glycosylated Hemoglobin Assessment Percent
Age	
18 to 44 years	29
45 to 64 years	23
65 to 74 years	13
75 years and older	11

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

During the past decade, scientific investigations have established that controlling certain macrovascular risk factors, such as elevated blood lipids and blood pressure, as well as microvascular factors, such as elevated blood glucose, will result in fewer diabetes-related complications. Further, identification of early indicators of organ damage, for example, microalbuminuria, and proper treatment with angiotensin-converting enzyme-inhibitors, will reduce progression to renal failure. Diabetes-associated complications can be detected with available laboratory and clinical measures, thus indicating the need for prevention programs. Monitoring these clinical and laboratory measures can serve to identify targets for intervention programs.[98, 99, 100, 101, 102]

5-13. Increase the proportion of adults with diabetes who have an annual dilated eye examination.

Target: 75 percent.

Baseline: 56 percent of adults aged 18 years and older with diabetes had an annual dilated eye examination (mean of data from 39 States in 1998; age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: Behavioral Risk Factor Surveillance System (BRFSS), CDC, NCCDPHP.

Adults Aged 18 Years and Older With Diabetes, 1998	Annual Dilated Eye Examination Percent
TOTAL	56
Race and ethnicity	
American Indian or Alaska Native	60
Asian or Pacific Islander	69
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	59
White	55
Hispanic or Latino	53
Not Hispanic or Latino	57
Black or African American	59
White	56
Gender	
Female	55
Male	58
Education level (aged 25 years and older)	
Less than high school	48
High school graduate	60
At least some college	58
Age	
18 to 44 years	51
45 to 64 years	61
65 to 74 years	65
75 years and older	65

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

5-14. Increase the proportion of adults with diabetes who have at least an annual foot examination.

Target: 75 percent.

Baseline: 55 percent of adults aged 18 years and older with diabetes had at least an annual foot examination (mean value of data from 39 States in 1998; age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: Behavioral Risk Factor Surveillance System (BRFSS), CDC, NCCDPHP.

Adults Aged 18 Years and Older With Diabetes, 1998	Annual Foot Examination Percent
TOTAL	55
Race and ethnicity	
American Indian or Alaska Native	40
Asian or Pacific Islander	57
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	55
White	55
Hispanic or Latino	56
Not Hispanic or Latino	54
Black or African American	54
White	54
Gender	
Female	51
Male	59
Age	
18 to 44 years	53
45 to 64 years	59
65 to 74 years	56
75 years and older	51
Education level (aged 25 years and older)	
Less than high school	46
High school graduate	56
At least some college	59

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

Health practitioner behaviors, such as blood pressure monitoring or eye and foot examinations, are associated with greater identification of early indicators of end-organ damage from diabetes. These screening behaviors are necessary to initiate secondary and tertiary prevention programs, and should be monitored.[103, 104, 105]

5-15. Increase the proportion of persons with diabetes who have at least an annual dental examination.

Target: 75 percent.

Baseline: 58 percent of persons aged 2 years and older with diagnosed diabetes saw a dentist at least once within the preceding 12 months in 1997 (age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: National Health Interview Survey (NHIS), CDC, NCHS.

Persons with Diabetes Aged 2 Years and Older, 1997	**Annual Dental Examination** Percent
TOTAL	58
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	56
Asian	DSU
Native Hawaiian or Pacific Islander	DSU
Black or African American	63
White	58
Hispanic or Latino	32
Not Hispanic or Latino	61
Black or African American	63
White	61
Gender	
Female	59
Male	57
Age	
18 to 44 years	64
45 to 64 years	68
65 to 74 years	68
75 years and older	65
Education level (aged 25 years and older)	
Less than high school	40
High school graduate	52
At least some college	65

Persons with Diabetes Aged 2 Years and Older, 1997	Annual Dental Examination Percent
Disability status	
Persons with disabilities	42
Persons without disabilities	66

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

Persons with diabetes are at increased risk for destructive periodontitis and subsequent tooth loss. [106, 107] In addition, untreated periodontitis in persons with diabetes may complicate glycemic control.[108] Regular dental visits provide opportunities for prevention, early detection, and treatment of periodontal problems in persons with diabetes.

5-16. Increase the proportion of adults with diabetes who take aspirin at least 15 times per month.

Target: 30 percent.

Baseline: 20 percent of adults with diabetes aged 40 years and older took aspirin at least 15 times per month in 1988-94.

Target setting method: Better than the best.

Data source: National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.

Adults Aged 40 Years and Older With Diabetes, 1988–94	Take Aspirin at Least 15 Times per Month Percent
TOTAL	20
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	9
White	24
Hispanic or Latino	DSU
Mexican American	8

Adults Aged 40 Years and Older With Diabetes, 1988–94	Take Aspirin at Least 15 Times per Month Percent
Not Hispanic or Latino	DNA
Black or African American	DNA
White	DNA
Gender	
Female	19
Male	21
Education level	
Less than high school	18
High school graduate	23
At least some college	19

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.

5-17. Increase the proportion of adults with diabetes who perform self-blood glucose monitoring at least once daily.

Target: 60 percent.

Baseline: 42 percent of adults aged 18 years and older with diabetes performed self-blood glucose monitoring at least once daily (mean of data from 39 States in 1998; age adjusted to the year 2000 standard population).

Target setting method: Better than the best.

Data source: Behavioral Risk Factor Surveillance System (BRFSS), CDC, NCCDPHP.

Adults Aged 18 Years and Older With Diabetes, 1998	Daily Self-Blood Glucose Monitoring Percent
TOTAL	42
Race and ethnicity	
American Indian or Alaska Native	53
Asian or Pacific Islander	30
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	40
White	43

Adults Aged 18 Years and Older With Diabetes, 1998	Daily Self-Blood Glucose Monitoring Percent
Hispanic or Latino	36
Not Hispanic or Latino	43
Black or African American	37
White	45
Gender	
Female	43
Male	41
Age	
25 to 44 years	43
45 to 64 years	41
65 to 74 years	44
75 years and older	38
Education level (aged 25 years and older)	
Less than high school	38
High school graduate	41
At least some college	44

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
Note: Age adjusted to the year 2000 standard population.

Certain activities, ultimately chosen by the patients themselves, are essential in the proper preventive management of diabetes. Smoking cessation, use of aspirin, and self-blood glucose monitoring are representative of individual behaviors that should be periodically monitored because each behavior is associated with a decreased likelihood of microvascular and macrovascular complications.[109, 110, 111, 112, 113] Aspirin therapy in persons with diabetes mellitus—especially in the presence of other cardiovascular risk factors, such as high blood pressure, elevated blood lipids, etc.—has been demonstrated to reduce the likelihood of a future heart attack or stroke.[113]

Related Objectives From Other Focus Areas

1. Access to Quality Health Services

1-1. Persons with health insurance

1-2. Health insurance coverage for clinical preventive services

1-3. Counseling about health behaviors

4. Chronic Kidney Disease

4-1. End-stage renal disease

4-2. Cardiovascular disease deaths in persons with chronic kidney failure

4-7. Kidney failure due to diabetes

4-8. Medical therapy for persons with diabetes and proteinuria

9. Family Planning

9-3. Contraceptive use

9-11. Pregnancy prevention education

12. Heart Disease and Stroke

12-1. Coronary heart disease (CHD) deaths

12-2. Knowledge of symptoms of heart attack and importance of dialing 911

12-7. Stroke deaths

12-8. Knowledge of early warning symptoms of stroke

12-9. High blood pressure

12-10. High blood pressure control

12-11. Action to help control blood pressure

12-12. Blood pressure monitoring

12-13. Mean total cholesterol levels

12-14. High blood cholesterol levels

12-15. Blood cholesterol screening

12-16. LDL-cholesterol level in CHD patients

14. Immunization and Infectious Diseases

14-5. Invasive pneumococcal infections

14-29. Flu and pneumococcal vaccination of high-risk adults

16. Maternal, Infant, and Child Health

16-6. Prenatal care

16-10. Low birth weight and very low birth weight

16-19. Breastfeeding

19. Nutrition and Overweight

19-1. Healthy weight in adults

19-2. Obesity in adults

19-3. Overweight or obesity in children and adolescents

19-16. Worksite promotion of nutrition education and weight management

19-17. Nutrition counseling for medical conditions

22. Physical Activity and Fitness

22-1. No leisure-time physical activity

22-2. Moderate physical activity

22-3. Vigorous physical activity

22-6. Moderate physical activity in adolescents

22-7. Vigorous physical activity in adolescents

28. Vision and Hearing

28-1. Dilated eye exam

28-5. Impairment due to diabetic retinopathy

28-10. Vision rehabilitation services and devices

Terminology

(A listing of all abbreviations and acronyms used in this publication appears in Appendix K.)

Ascertainment: The processes and systems used to collect information and data about a particular health condition, for example, written surveys, telephone calls, electronic records, etc.

Co-morbidity: The presence of serious health conditions in addition to the one being examined, for example, high blood pressure in people with diabetes mellitus.

Diabetes mellitus (diabetes): A chronic disease due to either or both insulin deficiency and resistance to insulin action, and associated with hyperglycemia (elevated blood glucose levels). Over time, without proper preventive treatment, organ complications related to diabetes develop, including heart, nerve, foot, eye, and kidney damage; problems with pregnancy also occur. Diabetes is classified into four major categories:

Type 1 diabetes: (previously called insulin-dependent diabetes mellitus [IDDM] or juvenile-onset diabetes [JODM]) represents clinically about 5 percent of all persons with diagnosed diabetes. Its clinical onset is typically at ages under 30 years. Most often this type of diabetes represents an autoimmune destructive disease in beta (insulin-producing) cells of the pancreas in genetically susceptible individuals. Insulin therapy always is required to sustain life and maintain diabetes control.

Type 2 diabetes: (previously called non-insulin-dependent diabetes mellitus [NIDDM] or adult-onset diabetes [AODM]) is the most common form of diabetes in the United States and the world, especially in certain racial and ethnic groups and in elderly persons. In the United States, approximately 95 percent of all persons with diagnosed diabetes (10.5 million) and almost 100 percent of all persons with undiagnosed (5.5 million) diabetes probably have type 2 diabetes.

Gestational diabetes mellitus (GDM): refers to the development of hyperglycemia during pregnancy in an individual not previously known to have diabetes. Approximately 3 percent of all pregnancies are associated with GDM. GDM identifies health risks to the fetus and newborn and future diabetes in the mother and offspring.

Other types: include genetic abnormalities, pancreatic diseases, and medication use.

Complications: Microvascular—small vessel abnormalities in the eyes and kidneys; macrovascular—large vessel abnormalities in the heart, brain, and legs; and metabolic—abnormalities in nerves and during pregnancy.

Diabetic acidosis: A severe condition of diabetes. Due to a lack of insulin, the body breaks down fat tissue and converts the fat to very strong acids. The condition most often is associated with a very high blood sugar and happens most often in poorly controlled or newly diagnosed type 1 diabetes.

Direct costs: Costs associated with an illness that can be attributed to a medical service, procedure, medication, etc. Examples include payment for an x-ray; pharmaceutical drugs, for example, insulin; surgery; or a clinic visit.

Formal diabetes education: Self-management training that includes a process of initial individual patient assessment; instruction provided or supervised by a qualified health professional; evaluation of accumulation by the diabetic patient of appropriate knowledge, skills, and attitudes; and ongoing reassessment and training.

Indirect costs: Those costs associated with an illness that occur because an individual cannot work at his or her usual job due to premature death, sickness, or disability (for example, amputation).

Prevention: Primary: stopping or delaying onset of diabetes; secondary: early identification and stopping or delaying onset of complications; tertiary: stopping disability from disease and its complications.

Thrifty gene: An idea which suggests that in people likely to develop type 2 diabetes, a "thrifty gene" is present. It is speculated that thousands of

years ago, people with "thrifty gene" could store food very efficiently and thus survive long periods of starvation. Now when starvation is unusual, this thrifty gene tends to make people overweight and thus prone to diabetes.

Urinary microalbumin measurement: A laboratory procedure to detect very small quantities of protein in the urine, indicating early kidney damage.

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